INTERNATIONAL HEALTH EXHIBITION

Supplements to The Builder.

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ELECTRIC LIGHTING.

WHATEVER may have been the success or failure of the electric light in making its way as an illuminant for general purposes, its bitterest opponents must admit its complete suitability for large areas, and for decorative effects on an extensive scale. Much progress has been made since the Paris Exhibition of 1881, the dazzling brilliance of which will probably never be surpassed, but the result there was brought about merely by the massing together of a large number of very powerful lights, and no attention was paid to their effective disposition. This barbaric splendour of illumination was succeeded at the Crystal Palace by a quieter display, which enabled the rival merits of different systems to be estimated, but here also, quantity of light was the prime feature. It is not surprising that this should have been the case, for the enormous power of the electric light above all other forms of illumination was the prominent fact that first riveted the attention of the world upon the new invention. It soon became apparent, however, that mere quantity of light did not constitute the only, nor in fact the chief, element of superiority in the new illuminant, and the rapid progress made in the manufacture of incandescent lamps soon showed that these could be made subservient to the decorative treatment of interiors in a manner that was quite out of the reach of gas. Great improvements were visible at the Fisheries Exhibition last year, many of the features of which are retained in the present Health Exhibition, but results are achieved here far superior to anything previously attempted. There has been considerable delay in completing the installations, many of which are not yet in operation, and we have, therefore, postponed till now our notice of the different systems of electric lighting displayed at the exhibition, which we propose to examine from the artistic rather than the scientific point of view; that is, looking chiefly at the effectiveness of the illumination and not touching the question of the economic value of any particular lamp or machine. This depends upon the relation between the candle-power of the lamps and the horse-power used in producing it, and can only be determined by making a number of accurate scientific measurements of electro-motive force, conductivity of wires, and various other matters which are not strictly within the province of this journal. We would merely warn our readers that the lamp which burns most brightly and steadily is not necessarily the best adapted for general use, as it may take an extravagant amount of power to drive it properly. The non-appreciation of this fact has been one of the chief causes of the cloud which now hangs over electric lighting. The public have visited exhibitions and have seen lamps burning splendidly, and have been informed that the lamps can be made and sold at a profit for a comparatively small sum, and then after a company has been formed for manufacturing the lamps, it has more than once turned out that they are unsaleable because, though cheap in themselves, they are too expensive to work.

To commence with the arc light systems:—the Jablochkoff, which was almost the first to show the capabilities of the electric light for street purposes, makes a very good show at the Exhibition. This system has been so often described that the Jablochkoff "candle" is probably the best known form of the arc light, but great improvements have been made since the first installation of this system on the Thames Embankment. The candles themselves burn more steadily, and their slight irregularities are to a large extent neutralised by the use of the Trotter prismatic glass shade, which enormously enhances the effect of these lights. There are thirty lamps exhibited, each containing two candles, and they are arranged in the South Central Gallery, and in the southern parts of the West Central and the East Central galleries. These lamps are worked by four Gramme self-exciting dynamos of the Jablochkoff pattern, giving alternating currents. The Brush Company light up the East and West Annexes with sixteen of their improved arc lamps, which, in our opinion, show more conspicuously than any others the great improvement which has been made in this system of lighting during the past year. On former occasions we have frequently watched a number of Brush lamps and found not one of them steady for sixty consecutive seconds; but these lamps, either from alterations in their construction or from the use of better carbons, burn with a beautifully clear steady light, which is all that can be desired, and which enables all the objects displayed to be examined down to the smallest detail with the greatest ease and comfort. The East and West Quadrants, the East Arcade, the third-class dining-room, and the Exhibition-road entrance are lighted by forty Brush lamps of the same pattern by the Hammond Company. In each case the lamps are driven by one continuous current machine.

We have not space to describe in detail the various other arc lamps exhibited, some of which are of a new type, and we can only mention where they are to be found. The upper part of the West Central Gallery is lighted by ten of the British Electric Light Co.'s Brockie arc lamps; in the west corridor are eight lamps of Clark & Bowman's patent; the large Central Gallery is brilliantly illuminated by twenty-five Hockhausen lamps, and six of these are fixed at the head of the mast in the grounds, giving nominally a light of 18,000 candle power; but there seems to be some difficulty in getting their full power out of all these lamps, as on more than one occasion we have noticed them to be of very unequal brilliance. The East Gallery is lighted by forty Gülcher lamps of about 350-400 candle power each (500 nominal), the distinguishing feature of which is that they are arranged similarly to incandescent lamps, viz., in parallel arc; that is to say, the current is not sent through the lamps one after the other, as in the case with nearly all arc lamps, but each lamp forms a bridge across from the positive to the negative main. This arrangement allows of a much smaller electro-motive force at the machine.

The exterior of "Old London" is illuminated very effectively with five arc lamps of the Lea patent, which are concealed as far as possible from direct view, so that the effect of diffused moonlight is obtained, and this adds greatly to the picturesqueness of the surroundings of Mr. Birch's excellent reproduction. In the west gallery are displayed the admirable Pilsen arc lamps, thirty-nine in number, which are not surpassed for steadiness by any others; these are driven by three Schückert dynamos. The conservatory next the Albert Hall is lighted by four Siemens's lamps of high candle power also arranged in parallel arc. The Sun Electric Light Company illuminate the cascades and part of the fountains, and also the centre of the dome of the Water Companies' Pavilion.

Among the lamps which we should have been glad to notice, as being new contributions, may be mentioned those of Messrs. Paterson & Cooper, Mr. Sennett, and Mr. Varley, who uses a new kind of flexible carbon, but none of these have yet been properly installed. There is probably very little to choose between the best specimens of the various arc lamps, and those will be most commercially successful which can be made and worked the cheapest. Before leaving the subject of arc lighting we must express our regret that no one has attempted to show the adaptability of these lamps for interiors by means of reflection,—that is, by grouping two or three lamps, and concealing their direct rays, which could be thrown upwards upon white screens and then reflected down, thus giving a white, equally diffused, and agreeable light. Of course, a considerable quantity of light would be lost in this way, but probably not more than is now absorbed by the thick ground-glass globes which are required for the more powerful lights.

The incandescent lighting at the Exhibition must be pronounced a great success, and so many different methods of arranging the lamps are shown that a very good idea can be formed of the decorative effects attainable from numbers of small lights. In the Fine Arts Gallery which forms the vestibule to the Exhibition Galleries, the effect of these small lamps in elaborate fittings can be studied, as Messrs. Verity & Sons have sent their large metal electrolier, on which ninety-nine Edison lamps are arranged; and immediately adjoining it is the glass electrolier of Messrs. Defries & Sons, with seventy-two Swan lamps. The former of these is an admirable specimen of metal workmanship, but it is too heavy and too ornate for its purpose, and we think, on the whole, the effect of the glass electrolier is preferable. We have, however, for some time held the opinion that elaborate fittings are a mistake with incandescent lamps, and the aspect of the large South Gallery fully bears out this opinion. Here not a penny has been spent on fittings, and the simplicity of the arrangement could not be exceeded. The roof of the gallery is supported by eighty curved trusses, each of which has thirteen struts with roughly-pointed ornamental ends. At each of these points is fixed one Swan lamp, so that there are altogether 1,040 in the gallery, and, when viewed from the top end, the effect of this long vista of lights following the curve of the roof is charming in the extreme. There is not the slightest glare, but a pleasant diffused light, with no shadows. In the Dining-rooms a different arrangement has been tried. Instead of fixing the lamps to the roof trusses they are attached to small pendants and are arranged in alternate groups of four Edison and single Swan lamps. This simple variation adds greatly to the general effect, which would probably have been somewhat monotonous if all the pendants had been alike. The lamps in the South Gallery are worked by two large alternating Siemens dynamos, and those in vestibules and dining-rooms by ten Edison dynamos, five of which are spare machines, in case of accident.

The dairies are illuminated by Mr. Crookes's incandescent lamps, variously arranged. In the Express Dairy some of the lamps are attached to pendants terminating in a ring of metal similar to gas star lights, and some are fixed round the woodwork of an elevated stand; in Welford's Dairy they are simply screwed up to the underside of the horizontal tie beam, but in both cases the effect is rather stiff. In the London & Provincial Dairy, the roof of which is like that of the South Gallery, the experiment has been tried of fixing the lamps not to the points of the struts, but to their sides, so that the lamps stand out horizontally. This seems to us a mistake, as if looked at on the side away from the lamps the effect is by no means good. All these lamps are worked by four Gülcher dynamos.

The Brush Company light the Vegetarian buffet with eighty incandescent lamps, but they

are attached to the arms of ungraceful brass electroliers, which are altogether too stiff and heavy for electric light fittings. The Woodhouse & Rawson lamps, which are to light the Aquarium and adjoining arcades, are not yet in position.

The Water Companies' Pavilion, which is octagonal on plan, with a domical roof, is well lighted, and here fittings are almost entirely dispensed with. In addition to the sun-lamp already mentioned, single incandescent lamps are placed along the ribs of the dome with differently-shaped shades, and the lower wall spaces have lamps enclosed in shades imitating various flowers, not altogether successfully. Four different kinds of lamp are in use here,—the Swan, the Woodhouse and Rawson, the Gatehouse,* and those of the Consolidated Company, and they are worked by one Oppermann machine.

The Doulton Trophy is lighted by twenty high-power lamps by the Gérard Company; and here, too, there are no fittings. Eight single lamps are arranged round the base of the dome, one each in the centre of the four arched entrances, and two each in the four corner rooms, the latter being so arranged that the contents of the rooms are brilliantly illuminated, but the lamps themselves are out of sight. This is a very successful installation, and the Gérard dynamo may be mentioned for its extreme compactness.

In the Prince of Wales' Pavilion a praiseworthy attempt has been made to show how the highest decorative effects can be obtained without elaborate fittings; but we cannot help thinking that if a little more thought and attention had been paid to this part of the work, a better result might have been obtained. In the ante-room there are three groups of eight lamps depending from a globe: there is ample light, but if the lamps had been more distributed, the effect would have been better. In the main reception-room a better arrangement has been adopted. The ceiling is divided into bays by flat ribs, and has plaster ornamental enrichments arranged so that the lamps can be attached to them. At each of the four intersections of the flat ribs is placed a group of three Swan lamps under an opalescent shade, and in the centre of the ceiling is a circular ring of sixteen lamps. These are undoubtedly too close together, and the effect would have been greatly improved if there were only eight in this ring, and the remainder distributed in the other bays of the ceiling. It is a great mistake to place these small incandescent lamps too close to each other in rooms where a distributed and not a condensed light is required. Nineteen similar lamps depend from the ceiling in the octagon room; and the private rooms, both of the Prince and of the Princess, are lighted by two groups of three lamps under one shade. Notwithstanding what we consider the defects in arrangement, the effect of these lamps is very pleasing, and it shows conclusively that with the electric light, a large outlay on fittings is neither necessary nor desirable.

On the whole, the lighting of this vast Exhibition is most excellent, and this is, doubtless, due to the fact that the illumination has been carried out under one management, that of Mr. W. D. Gooch, who has had the control of all the installations, and whose aim has evidently been not that any one exhibitor should throw his rivals into the shade, but that all the buildings should be perfectly lighted, and he is to be heartily congratulated on his success. The magnitude of the undertaking is almost appalling. Nearly 400 arc lights and between 5,000 and 6,000 incandescent lamps will be in use when the installations are all complete, and nearly 150 miles of insulated cable will be required, all of which is supplied by Henley's Telegraph Works Company. The engines are supplied by Messrs. Davey, Paxman, & Co., and over 1,000 indicated horse-power is employed.

METEOROLOGY.

The Meteorological Section of the International Health Exhibition is very small, and does not approach to anything like the full and instructive exhibit it ought to have been, either as representing the power of meteorology as a science or its utility in the world; and the foreign countries are not at all represented, some of these (as, for example, Belgium) having instruments of exceeding interest, which it would have done great public service to have had displayed. Even less than a third of the East Corridor annexe is occupied by matters appertaining to meteorology; indeed, it is chiefly by diagrams on the walls that it puts in its appearance, and to which may be added a few cases of instruments by Casella, Negretti & Zambra, Dring & Fage, and some others, all well known for excellence. A very large portion of the building is occupied by the Anthropometric laboratory of Mr. Francis Galton, who has an attendant always present to take the sizes, weights, and strengths of all comers, and to test their eye-sight, sense of colour, and accuracy of judgment in mechanical division and form, and other details useful for tabulation for the purposes of biological research. There are also some very limited exhibits of astronomical and philosophical instruments, of which Mr. Latimer Clark's exquisite little window transit is exceedingly well worthy of attention. It is remarkably neat, and has the great practical advantage that the instrument may be lifted off its bearings, its index and vernier set to the required position in the light of the observer's room, and, on being dropped back again on to its bearings, the star sought for will be seen at the first observation. To bring the object exactly into the centre of the field of view there is provided a fine adjustment screw. It is designed for window use, but it may be set on a solid pedestal. The base-plate, which is circular, about 6 in. in diameter, is adjustable by levelling screws working upon an intervening spring after the plate has been firmly screwed in its place by a central screw. A cap is made to cover the bed-plate, as the transit instrument can be taken away when out of use, there being no trouble of fitting or unfitting, as the trunnions rest loose in the grooves of the bearings, and the tail support of the body, with prism inclosed, rests on the surface of the bed-plate as the trail of a gun rests on the ground.

The two chief meteorological exhibitors are the Meteorological Society of London and the Meteorological Department of the Board of Trade. The exhibit of the former consists of a typical climatological station fitted with the instruments used for meteorological purposes, and in working order, in the Garden grounds, near the Central Fountains; and observations are recorded and published daily. In the East Corridor Annexe they have a series of diagrams on the south wall giving a variety of information which is left to speak for itself, and to those who can understand it. One of these diagrams gives the highest and lowest temperatures attained at various geographical places alongside the scale of a gigantic drawing of a thermometer. The highest heats, commencing with Murzook 135° Fahr., and diminishing in regular order to Cooper's Creek 128°, Bagdad, Cairo, Adelaide respectively 120°, 117°, 110°, Sidney 108°, Jerusalem 104°, Greenwich 98°, Moscow 90°, and Falkland Islands 77°.

The lowest temperatures range from Barbadoes 75°, Singapore 68°, Lima 58°, Bombay 54°, Senegal 48°, Jerusalem 27°, Constantinople 18° above zero, Leh giving the zero, and then Greenwich leads for degrees below zero with minus 9°, Toronto 25°, Chicago 28°, Winnipeg 40°, Moscow 46°, Melville Island 54°, Bocoslowski 62°, Fort Reliance 68°, Semipalotensk 75°, and Metchopansk minus 80° Fahr. There is another similar diagram giving the mean temperatures for a number of other places, varying from Ferozepore at 85° Fahr. down to 2° above zero for Melville Island. There is another diagram of considerable interest, one which depicts the deaths by bronchitis, fevers, diarrahœa, and deaths from all causes, in comparison with the temperatures in the metropolitan area for the period 1859 to 1861. The curves are drawn under the temperature divisions and are measurable by the per-centage scales at the sides. In the case of deaths by bronchitis they were at their maximum when the temperature was under 35° Fahr., and they were 25 per cent., diminishing to 20 per cent., with temperatures under 40°, and to 10 per cent. when the temperature was under 50°, decreasing still further as the temperature rises to midway between 65° and 70° when the deaths increase again up to 75° of temperature. The fever deaths vary but little from a nearly uniform line of from 10 to 15 per cent. Diarrahœa, on the contrary, is at zero with 35° of temperature, and the deaths continue to follow a nearly level line as far as 45° of temperature, commencing then to rise from 10 per cent. to 20 per cent., and thence going up sharply until at 75° the deaths reach 45 per cent. Deaths from all causes continue from first to last very little above or below the level. We see hence clearly, that the diseases of the breathing organs and of the digestive organs are mainly caused by variations of temperatures, in the former case by diminished, and in the latter case by increased, temperature. The curve of the deaths from all causes rises up a little at each end, respectively representing the extremes of cold and of heat.

The diagrams shown by the Meteorological Department of the Board of Trade are coloured outlines of the British Isles, representative of the hot and cold temperatures of the sea around the coasts for each month in the year. So far as we know, there is no explanation of any kind appended to them, but the eye takes in at a glance some of the more curious features, one of which is the intensified colour of the red tint around the Foreland coast of Kent, in the estuary of the Severn, and in an indent of the west coast of Ireland towards Galway. The cause of this rise in the temperature of the sea in the summer months around Margate, Ramsgate, and Deal would seem to be due to the shallowness of the water, and it may possibly also be slightly intensified by the breaking out of submarine fresh-water springs from the fissures of the geological strata of white chalk which there forms the sea-bed. The estuary of the Severn effect may be perhaps due to the fresh-water conditions contributed by the river; but the Irish incident appears to be of more erratic origin, as it is not persistent in consecutive months. The local intensifications of the blue colour which represent unusual degrees of cold are also very curious, but their explanation is not easy without assistance.

The sunshine indicators and records, shown by Mr. Lecky, are interesting and instructive, and he ought to have due credit for providing printed sheets of explanation for the acceptance of the public. The records are taken from the station of Mr. Dymond, at Apsley Guise, in Bedfordshire, with a sunshine recorder fitted with Professor Stokes's zodiacal frame, and which station was selected as being a central one for the South of England. The number of hours during which the sun might be visible is:—January, 259; February, 279; March, 367; April, 415; May, 482; June, 494; July, 497; August, 450; September, 377; October, 328; November, 265; December, 243 hours. The per-centages of sunshine for the past year were January, 21·6; February, 28·2; March, 37·6; April, 33·4; May, 35·6; June, 36·6; July, 27·4; August, 39·7; September, 32·5; October, 25·2; November, 33·1; and December, 9·8 per cent. The per-centages are given respectively for the three years 1881, 1882, and 1883, the principal features in the general results coming out that last December the sunshine was less than 10 per cent., and that only in May, 1882, did it exceed 50 per cent.; whilst in the year 1881 there was, on the whole, only a trifle in excess of one-third of the total possible amount of sunshine, and both in 1882 and 1883 the proportion was less than this.

The Kew Observatory contents itself with exhibiting a certificate of test of a clinical thermometer,—a commercial rather than a scientific appearance, as some might think, for such an occasion.

Amongst the instrument-makers' exhibits, Casella has a very fine anemometer and recording cylinder; and Tisley & Co., Denton, Stanley, Watson, Frost, and Cetti have small but very good displays of the special articles for which each has a reputation. The first-named firm, we believe, have supplied the measuring and testing instruments for Mr. Galton's anthropological measurements and tests.

THE DAIRIES.

The dairies and bakeries form two of the most important features in the Exhibition; and although the three large exhibits of the latter class are not so attractive as the three principal dairy displays, the practical interest between the two is fairly well balanced. Both the bread-making and milk and butter purveying trades of the metropolis appear to be undergoing a marked change at the present time. Neither of these industries has been to a great extent affected by the great co-operative movement of the last few years; but the advantages of concentration of management and capital have none the less made themselves felt, and have been turned to good account by those possessing the foresight and enterprise to profit by

* Fifty of these lamps will also be used in "Old London" when the installation is complete.

this field of industry. A few years ago the local baker and the local milkman "served" their immediate district without fear of opposition excepting from neighbouring tradesmen. Now such firms as Messrs. Hill & Sons amongst the bakers send their produce all over the metropolis, from Stratford in the east to Hammersmith in the west, or between Hornsey and Croydon in a north and south line. In the same way the carts of many of the large retail dairymen travel over a wide area in our local geography; and from the uniform excellence of the goods they supply, and the punctuality with which they carry out their engagements, seem as if they would all but exterminate the smaller shops.

Dairy produce may be divided into milk, cream, butter, and cheese. Milk is generally regarded as a model food, and no doubt if our stomachs could be governed by the dictum of laboratory research, a diet of milk alone would leave little to be desired. Our digestive organs, however, give a far more subtle analysis than can be obtained by the most elaborate scientific investigation, and as a matter of fact a large number of grown people find raw milk a very indigestible food. This is altogether contrary to popular belief, for it is argued that if a newly-born infant can assimilate milk, surely an adult can do so too. In some respects, however, an infant may be stronger than even a grown man, and this would appear to be the case with regard to the digestion of milk. It will be remembered, however, that human milk, the natural food of infants, contains less solid matter, especially casein and other albuminoids, than does that of cows, although the quantity of milk sugar (lactose) is greater in the former by about 1·8 per cent. It is for this reason that water and sugar are added to the cow's milk used in the artificial feeding of infants. So far as can be ascertained, very little adulteration takes place in milk in the present day compared to that which was practised before legislation made dishonesty in this direction dangerous, or at least unprofitable. The belief that calves' brains and chalk are used for this purpose may be considered entirely unfounded; the only adulteration now practised being the comparatively harmless one,—if the water be pure,—of the pump. The milk supply may, however, be the means of spreading disease to a far greater extent than would arise from any adulteration by noxious ingredients. Milk, in common with like fatty matters, has the power of absorbing emanations from other substances, and if allowed to remain in proximity to sewer gas, will become a most unwholesome, not to say poisonous, compound. The germs of disease may also be introduced into milk through the agency of the water used in washing the various dairy utensils. The subject is an important one, but requires no further mention here, as it has been exhaustively treated in a conference recently held at the Exhibition.

Butter is the item of second importance in dairy economy. When pure it is more especially a heat-giving article of diet, the calorifacient principles being the most important. It differs in this respect from its sister product, cheese. In the latter the essential constituent is casein, a proteid or flesh-forming principle of food. Of course the richer cheeses, more especially the fancy cream cheeses which have become so popular of late, contain a great deal of fatty matter, and even Cheddar or Gloucester will have about equal quantities of fat and casein in their composition, whilst in a poor skim-milk cheese the proportion of fat will, perhaps, not be above 6 per cent. Up to the present, however, there is, we believe, no example of cheese-making to be seen in the Exhibition, and we will not, therefore, enlarge on this important branch of industry, which, it may be remarked, in passing, has been taken from us to so great an extent of late years by the better organisation of other countries.

A good deal has been said and written lately about the adulteration of butter, and certainly not without cause. When it is remembered that it requires from twenty to twenty-three pints of milk to produce one pound of butter it would seem reasonable to suspect that the vast quantities of produce sold under the latter title cannot all come from the cow. In a previous notice of the Exhibition (p. 736, *ante*) we made brief mention of Messrs. John Knight & Son's exhibit. It may seem invidious to treat of the productions of this firm under the present heading, yet some of the butter-shop keepers have so successfully obliterated the distinctions that lie between real and artificial butter, that perhaps we may also be excused for a little mixing of the two subjects. It is but fair, however, to the dairy firms we are about to mention to say that such high-class produce as they have on sale at their stands could not be obtained by any manufacturing process other than the simple churning of cream. Messrs. Knight & Sons are a very respectable and old-established firm of soap-boilers, their "Yellow Primrose" having been for generations literally a household word. They now very frankly announce themselves as makers of oleo-margarine, and take some pride in the fact that they can produce as much as twenty tons of this substance in a week. Animal fat, from which oleo-margarine is prepared, is compo[illegible] the three elements, carbon, oxygen, and hy[illegible]ogen, and these are combined in the principles oleine, margarine, and stearine. The latter is more abundantly present in mutton than in beef fat, and for this reason, as will presently appear, beef suet is more suitable for making into oleo-margarine than the fat of sheep. Stearine remains solid at much higher temperature than oleine or margarine, and this renders it an undesirable article for the butterine manufacturers' use. It is, therefore, extracted from the fat operated upon, and ultimately appears in domestic life in the form of candles. The remaining oleo-margarine is the raw material from which the butterine manufacturer makes his finished article. Owing to the different temperatures at which the stearine and oleo-margarine become solid, the separation is easily effected. The fat is melted, and allowed to cool gradually, the stearine being taken out as soon as it becomes solid, and while the remaining two constituents are yet liquid. These latter solidify at a temperature of about 60° Fahr. The "dairy" processes by which oleo-margarine becomes butterine have never, so far as we are aware, been made fully public, but the greatest art lies in the flavouring. This is variously carried out, either by means of chemicals, or by whey obtained from the churning of real butter, and more or less resembles that of the genuine articles, according to the skill of the operator or the scientific attainments of the presiding chemist. It should be remarked, however, that oleo-margarine is a wholesome article of diet in itself, supposing it be prepared from fresh wholesome fat, such as Messrs. Knight & Sons state they use. It is probably equally effective as a heat-producing food as the best butter, and no doubt quite as nutritious, excepting that it is not so palatable. The zest with which food is eaten has no small influence on the good effect it produces.

To return, however, to dairy produce proper, as represented in the Exhibition, we find that the three principal stands are those of Messrs. Welford & Sons, Limited, whose chief office is in Elgin-road, Maida-vale; the London and Provincial Dairy Company (Messrs. Fuller & Watts), chief office, 4, Halkin-street West, Belgrave-square; and the Express Dairy Company, Limited, of Bloomsbury Mansions. Each of these firms contributes a complete model dairy, in which the whole operation of producing milk and butter can be carried out in a practical form. Indeed, as a matter of fact, the cows which are kept on the premises supply the milk, or part of it, which is retailed in the Exhibition for the refreshment of visitors, or from which the cream is taken for conversion into butter. All these three dairies are placed next to each other, and are generally arranged in a somewhat similar manner: light structures, opening into the great south gallery, having been erected for the purpose. Messrs. Welford & Sons' display is the first that is reached when coming from the principal entrance. The gallery frontage is picturesquely arranged in the old English style, and in itself is an attractive feature in this part of the Exhibition. The cows are placed in a shed at the back of the stand, or perhaps we should rather say premises, considering the extent of the display. They consist of Jerseys, Alderneys, and Scotch-polled. A cross between an Alderney and a short-horn is also shown, and is found to be a very good breed for general work, as it will give an abundance of high quality milk. In the dairy portion of the show the first thing to claim attention is Lawrence's patent capillary refrigerator. This consists of a series of metal tubes, through which a stream of cold water ascends, whilst the milk to be operated upon trickles downwards over the corrugated surface formed by the superposed tubes. It is a thoroughly established fact that milk which is allowed to cool gradually will not keep for so long a time as that which is suddenly cooled. In ordinary weather the latter will remain fresh for two days. So far as we are aware the reason for this has never been ascertained, but, nevertheless, the fact remains. Milk passed through a refrigerating process directly it is taken from the cow loses the peculiar animal smell so often noticed in that obtained from small provincial dairies, where modern appliances have not been introduced. For making butter, the milk which is taken from the refrigerator, or that which is brought in from the country, is poured into a metal tank placed about 7 ft. or 8 ft. above the floor. As the railway churns in which it is carried are somewhat heavy for hand manipulation a small power lift is provided. This raises the churn and automatically tilts its contents into the tank, and then returns the empty churn to the floor. From this tank the milk is run into one of De Laval's patent centrifugal cream separators; for, since this apparatus was exhibited at the great Kilburn show in 1879, the practice of letting milk stand until the cream rises has become quite obsolete, so far as the best-conducted butter-making establishments are concerned. De Laval's apparatus consists of a vertical shaft mounted upon a cast-iron standard, and driven by a small grooved pulley at the lower end. On the top of this shaft there is attached a receptacle into which the milk is run in a continuous stream. It falls upon a "spreader" placed in the centre of the bottom of the vessel. This spreader is composed of a small cone standing in a cup-like inclosure. The apparatus is caused to revolve at the remarkably high speed of 6,500 revolutions per minute, and the lighter constituents of the milk which form the cream remain in the centre, whilst the heavier parts, by their superior momentum due to the centrifugal force, find their way to the outer part of the revolving vessel, by way of a small pipe leading from the cup mentioned. A tube leads from that part of the vessel to which the skim milk is forced, and up this the latter passes into an outer casing, and thence is drawn off into suitable receptacles. The cream remains in the form of an annular core, and rises until it reaches a small aperture, through which it escapes into a space provided for it, and thence is drawn off for use. Messrs. Welford have two of these machines at work at the Exhibition, each capable of treating sixty gallons of milk per hour. We understand that by the use of this separator, out of every thirty gallons of milk an additional 3 lb. of butter will be obtained over that reached when hand-skimming is followed. It is also claimed that the cream got by centrifugal separation is far superior to that resulting from hand-skimming. This, no doubt, is in most respects true, and probably so far as butter-making is concerned is entirely so; but by hand-skimming the globules of the cream do not get broken up in the same way that they do in the machine, and this has a considerable influence on the flavour of cream itself. For making butter, Messrs. Welford & Sons have three churns at work in the Exhibition. The principal of these is Taylor's eccentric churn. This consists of an octagonal oaken barrel, mounted in a suitable frame, and supported at each end by two pins attached to the heads. These are both placed eccentrically to the ends of the churn, and are not opposite each other, so that a line between them would be oblique to the axis of the barrel. In this way a peculiar compound motion is obtained, which is very effective in making the butter come. In the interior of the barrel projecting points are fixed, which help to break the butter so that it does not require as much working after being taken out. The churn shown at work is known as No. 5, and will turn out 40 lb. at one churning of twenty minutes. A larger churn of this description, which will make 150 lb. of butter at one operation, is also shown. There is also on this stand a churn of the same kind, excepting that it is made entirely of marble. The advantage claimed for this is that the marble being a non-conductor of heat, the contents of the churns are kept at a uniform temperature throughout the process of making the butter. This is a point of great importance. In making butter the temperature of the cream should be as nearly as possible 62 degrees Fahr. If the

heat is greater the butter will be soft and will lose the delicate flavour that it should have when made from good cream, and properly churned. On the other hand, if the temperature be too low bad effects will follow through the work being unduly prolonged. Ice or hot water is sometimes put into the churn and mixed with the cream. This, however, should never be done, but these substances should be contained in a suitable metal chamber so as not to be brought in contact with the churning. This is the system followed by Messrs. Welford & Sons. A Bradford diaphragm churn is also shown at work on this stand. It is simply an octagonal barrel hung horizontally in a suitable frame. The diaphragm is removable, and is composed of three or four slots placed at varying angles to each other in a frame. The motion is obtained by friction-wheels, on which the pins rest that support the barrel. The churn shown is worked by hand, and has a capacity of 28 lb. of butter per churning. An older description of machine is Bradford's Cotswing churn, which is also shown at work. It is simply an oblong box hung in a double X frame. There is nothing inside to break up the butter, the ends acting as beaters. The motion is obtained by hand.

After the butter is taken from the churn it is broken up by one of the many kinds of mechanical butter-workers used. In order to preserve the butter, it is necessary that every particle of whey should be expelled, otherwise fermentation will be set up and lead to that disagreeable cheese-like flavour which is sometimes met with. The old plan was to work the butter by hand, but this is a long and tedious operation, and mechanical kneading is now all but universal in English dairies of any importance, as it has long been amongst those of the Continent. The butter-workers are, as we have said, of many patterns. The principal one, shown by Messrs. Welford, is "Bradford's Albany." A flat tray is mounted on a stand, and sliding on the edges of this tray is a frame in which a grooved roller is made to revolve by hand. In this way the butter is pressed out into a fluted layer and is effectually broken up. When not in use the roller can be dismounted, and the tray reversed so as to form a washing-up table. Considerable importance is attached by this firm to a method of hardening butter, which has been introduced from Denmark. The process is carried out by means of certain boxes which have circular holes bored in the bottom, and above this is a wooden grating on which the butter is placed after having been wrapped in cloths. A leaden compartment is placed in the upper part of the box, and this is packed with ice. The cold air circulates through the box, and so hardens the butter. The drainage of this model dairy is arranged on the same principle as that followed on the actual working establishments of the firm. So far as we could judge, there is nothing special about this requiring description here. It appeared to be simply an ordinary well-devised arrangement by which the connexion between the drain and sewer is broken outside. The point is none the less one of great importance in the hygiene of dairy practice, for reasons before referred to.

Adjoining Messrs. Welford's dairy is the excellent display of the London and Provincial Dairy Company. This firm obtains its supplies from its own farms, which are situated near Devizes, in what is reputed to be the best part of the Wiltshire district. Many of the machines shown on this stand are similar to those already referred to, and further description of them will therefore be unnecessary; for instance, De Laval's centrifugal cream-separator, and some other appliances of this nature, are in operation. The whole is driven by a 2½-h.p. Otto gas-engine; one of Messrs. J. & E. Hall's cold-air machines is also shown, and can be applied for the various refrigerating purposes so necessary in dairy practice. A Botts capillary milk refrigerator is used. This is in principle similar to the Lawrence apparatus before described, but is fitted with opening sides so that the interior of the tubes can be examined should the necessity for doing so arise. A large Hathaway's power churn is the principal one in use. This is a cylindrical barrel placed horizontally and fitted with diagonal beaters inside. A very beautifully-made working model fitted with glass ends, so that the operation can be seen, is also shown. A second churn here at work is by Hathaway. It consists of an oblong box placed above a suitable frame, and supported in the centre by a vertical arm, which is connected at its lower end to a crank. By rotating the latter the churn rises and falls. At one end the churn is also connected directly to a crank the turning of which gives a horizontal movement to the box, the vertical arm pivoting on the box so as to allow of this action. In this way a compound movement is obtained, which is very effective in making the butter "come." We are informed that when running at 150 revolutions the churning only takes three minutes with this machine. The apparatus shown is power-driven, and will turn out 20 lb. at one operation. Several hand butter-workers are shown, amongst them the "Albany" before mentioned. A power-driven machine is also working. This is a Bradford's "Springfield," in which a circular table rotates under a fluted cornice-roller which also rotates. In this way the butter works upwards by a differential motion, and is very effectually broken. A great many smaller dairy appliances are also at work on this stand, but our space will not allow us to carry the subject further. To those interested in such matters, however, they are well worth inspection.

What bids fair to be the most interesting feature in this display is the cheese-making plant, which, unfortunately, is not yet complete. Possibly we may have an opportunity of returning to the subject when Messrs. Fuller & Watts get the machines in working order.

The third large display is that of the Express Dairy Company. The most noticeable features in this stand are the two large Hamburg centrifugal cream-separators. In these the separating vessel is vertical in place of being horizontal, as in De Laval's apparatus. The diameter is greater in the former than in the latter, and a higher peripheral speed is therefore obtained with a fewer number of revolutions, the machine only making 1,500 turns per minute. The extraction of the cream is effected in a manner which appears somewhat curious at first sight. The central part of the casing of the revolving vessel is cut away, and as the machine spins round at the very high speed the milk and cream are naturally thrown violently outwards by centrifugal force, leaving a circular space in the centre. A pipe is brought forward from the outside and inserted through the hole where the casing is cut away, being thus brought in contact with the inside of the revolving annulus of milk and cream,—the cream, of course, occupying the more central part of the annulus, on account of its lower specific gravity, as already mentioned in describing De Laval's machine. In this way a flow of cream is obtained through the pipe, and is greater or less according to the distance the pipe is thrust forward. The end of the pipe is cut in a plane diagonally to its axis, and the lip so formed directs the cream into the bore. The operation is exactly the same as that of turning out a hollow piece of work in a lathe, the pipe representing the tool. So great is the compressing force generated by the centrifugal action, and so rapidly do these machines revolve, that even so smooth a substance as cream exerts a considerable abrading power, such as, it is said, would soon take the skin of the end of one's finger if pressed against the surface. On this stand are many other dairy appliances, several of which we have already described.

THE PRESERVATION OF FOOD.

IN a former notice we promised to give a fuller account of the cold air machinery exhibited by Messrs. J. & E. Hall in the "Machinery in Motion" Department. Messrs. Hall show two of their smaller-sized cold-air machines, adapted for preserving all kinds of perishable articles of food by means of cold dry air only, and entirely without the aid of any chemicals or gases. The machines are connected with a cold store on a small scale, in which Australian and New Zealand mutton is stored to demonstrate their practical working. The cold is produced by compressing the air in one cylinder, and this causes it to become very hot; it is therefore passed over a number of tubes in which cold water is circulated, but the water is not allowed to come in contact with the air. The temperature of the air is thus reduced to nearly that of the water. It is then admitted to another cylinder, in which it expands, and whilst helping to work the machine, it becomes very cold, and is delivered perfectly dry into the cold store. Messrs. Hall make six different sizes of machines, and the temperature of the air delivered varies from 30° below zero Fahr. for the small ones to 100° below zero for the largest ones. We are informed that, owing to the perfection to which this class of machinery has been brought, it is now possible to obtain prime mutton from Australia and New Zealand for 7d. or 8d. per pound. Their sphere of usefulness is, however, by no means limited to the foreign dead meat trade; they are employed for the preservation of fish, poultry, milk, butter, fruit, vegetables, &c.; also in connexion with bacon-curing, chocolate-making, and for a variety of other purposes. Messrs. Hall have also fitted a large number of passenger steamers with these machines for preserving the food, cooling the potables, and making ice. The special features about the two machines exhibited are their extreme compactness and noiseless working. They are fixed vertically for convenience sake, but can equally well be placed horizontally. The larger of the two delivers from 5,000 to 7,000 cubic feet of air per hour at a temperature of 75 deg. below zero, according to the speed at which it is worked, and will preserve eighty-five tons of meat or its equivalent in other food. The smaller one delivers 2,000 cubic feet of air per hour at a temperature of 35 deg. below zero Fahr., and will preserve twenty tons of meat, or its equivalent in other food. Messrs. Hall also exhibit in practical working a still smaller machine and a cold storage-chamber in connexion with the London and Provincial Dairies Co., South Gallery, for preserving dairy produce.

BATHS, LAVATORIES, DRAINAGE, WATER-FITTINGS, &c.

CONTINUING our notice of this class of exhibits, we may this week commence by directing our readers' special attention to the exhibits (Stand 409, Central Gallery) of Messrs. Joseph Cliff & Sons, of Wortley, Leeds, and more particularly to this firm's "Imperial" porcelain bath, which for excellence of finish and for lightness and strength is not excelled, if it is even approached, by any other exhibit of the kind in the collection. One of these baths is shown lined with white enamel, and another lined with pink. A pleasing effect is obtained by an inlaid tile border, cemented in after the bath has been fired, a groove or channel being left near the top edge of the bath for their insertion. Where the tiles are well chosen, this may be made the means of a very effective decoration. Materials for bath room wallings, in the shape of majolica and glazed brick, are shown by the same exhibitors, who have, indeed, fitted up what may be called a model bath-room and kitchen, for the purpose of showing the action of their appliances. If happiness be in any degree dependent upon the ease and facility with which one's work can be done (as it undoubtedly is), happy should be the house-wife or hand-maiden whose kitchen or scullery is provided with one or another of the white glazed fire-clay sinks or washing-troughs shown by these exhibitors. These sinks are sure to be appreciated wherever they are used, for they are exceedingly cleanly and very convenient, their merits being strongly recognised by our cousins on the other side of the Atlantic, who import them and mount them in the manner shown at the stand. Lavatory basins, a white glazed fire-clay hospital slop-sink, a very good and useful house-maid's slop-sink, and a porcelain sitz bath, go to make up what is, with the decorative and constructive majolica already noticed, one of the most useful exhibits in this section of the Exhibition.

At Stand 375 in the South Central Gallery, Messrs. W. Phillips & Son, of Baker-street, exhibit a couple of large models showing at a glance the necessary arrangements for the easy inspection and perfect disconnexion of the drains of a house. One of the models is that of large premises in Oxford-street where the business of a pork-butcher is carried on, and where it was necessary to take special means for the interception of fat and other matters. The exhibitors' patent "Simplex" sewer-gas intercepting trap is a direct cleansing syphon trap of special form, with inspection-cap through which it is possible for a man to put his hand right into the bottom of the bend or dip of the trap. The patent grease-gully shown by this firm is well calculated to achieve the end aimed at, and is, we believe, used on the premises just mentioned. The other model shows the drainage

arrangements of a large house at Notting-hill, as carried out by the exhibitors under the direction of Mr. Edward Vigers, architect. As instructive examples of the dangers of bad plumbing and unventilated soil-pipes, Messrs. Phillips & Son show a number of old D-traps, cut open and shown to be clogged up with foul deposit. Also a number of pieces of lead soil-pipe with numbers of holes eaten through them by sewer gas, plainly emphasing the oft-repeated injunction, "Ventilate your soil-pipes!" It may also be mentioned that Messrs. Phillips's stand is decorated by themselves with non-poisonous materials, which they claim to be durable, washable, and non-infectious.

Messrs. Beck & Co., at Stand 541, in the Eastern Annexe, exhibit, besides the sanitary fittings and brasswork already noticed, Bell's patent screw-down double-valve gun-metal stop-cocks, which have been specially designed to meet the requirements of the metropolitan water companies under the Board of Trade regulations. They have a full water-way, and when it is necessary to discontinue the supply to any house, the cover can be unscrewed and the upper valve taken out (without shutting-down and emptying the main); the cover can then be replaced and the upper valve returned to the engineer's office with the "cutting-off order," as a proof that the work has been carried out. The bottom valve being closed by the pressure of the water, it is impossible to obtain any water until the upper valve has been replaced. The screw-spindle does not rise when the cock is opened, and being fitted with a guard, grit is prevented from getting to the working parts. This stop-cock is well worth attention, as are Bell's patent screw-down gun-metal bib-cocks.

Mr. G. Clutterbuck (Stand 572, Eastern Annexe) shows his patent "simple syphon" water-waste preventer, which has no valves, leather, or rubber washers, which appears to be effective and likely to stand wear and tear.

Mr. Francis Botting, of 6, Baker-street (Stand 659, East Arcade), exhibits models and full-size details of the means taken by him for disconnecting water-closets and waste-pipes from direct communication with the main soil-pipe, so dispensing with branch ventilating-pipes. The appliance by which this end is sought to be attained (and, it is claimed, with success) is known as Durrans's patent valve. It is the invention of an architect, and consists of a valve so arranged that it shuts without any mechanism, and opens with the slighted flush of water, allowing every drop from the branch soil or waste pipe to drain away. Where this arrangement is applied, it is not thought necessary by the exhibitor to fix traps under valve-closets, whereby a better flush can be obtained than when the water has to pass a trap. The main soil-pipe is, of course, ventilated. Over the patent valve (the principle of which is, in short, that of the tide-flap of a sewer) is an access door for inspection. It is claimed by the exhibitor that with the use of this patent valve attached to each branch or waste pipe discharging into the main soil-pipe, the latter is sufficient for all purposes,—for closets, baths, and lavatories. The same exhibitor's air-tight cover for inspection-pits, his cast-iron accessible trap, and his fresh-air inlets for the ventilation of drains, have been noticed by us with commendation on a previous occasion.

At Stand 1,294 of East Central Gallery A, Messrs. Horn & Son exhibit Homewood's Improved Water-waste Preventer for water-closets. In this apparatus, the raising of what is, apparently, a kind of spindle-valve at one end of the syphon, admits water at that part, and the flow of this water causing a vacuum, the syphon becomes charged from the cistern at the other end, and the cistern is rapidly emptied. It is claimed that by this invention a waste-preventing cistern containing three gallons of water supplied from a cistern standing only 2 ft. above the other, through a ¾ in. ball-valve, and discharged through a 1¼ in. valve, can be emptied and refilled in one minute.

Messrs. G. & W. Hughes exhibit, at Stand 996, near the main entrance, a drawing of an arrangement comprising a cistern for giving a full supply of filtered water for drinking and culinary purposes; also an apparatus for supplying disinfectants to water-closets.

Messrs. Lawson & Donkin (Stand 545 in the East Annexe) forward us some particulars of their patent "combination" earth and water closet, briefly referred to by us a fortnight ago. The point which they have endeavoured to achieve in it is the perfect separation of the solid from the liquid excreta, in the first instance, so that water and earth may each be used for its own legitimate purpose, without either being mixed with the other: the natural advantages of each medium being distinctly applied and brought into action by one movement and one apparatus, being in all other respects similar to the best kinds of water-closets now in ordinary use. These results they claim to obtain, primarily, by a basin so divided as to form a perfectly-trapped urinal in front, while the larger portion in the rear is provided with a pan, which receives the fœces in the usual way, but charged with earth instead of water. The action controlling the supply of earth is very simple, and automatic, being effected by substituting their patent earth-valve for the present water valve. The water is supplied and discharged from the urinal by raising a handle at the side, in the ordinary way; and the urine alone is thus conducted to the drain, but the conducting-pipe, containing fluid only, can be made entirely independent of, and disconnected with them. The fœces, being kept separate, are deposited in earth (or other deodorising material), and afterwards covered by it through the automatic action of the closet, when it is ultimately conveyed outside by a vertical soil-pipe, and discharged into a receiver constructed for the purpose. It will, of course, be necessary to make proper provision for its constant and regular removal.

Before leaving the East Annexe, we may point out that here are to be seen and tested a great variety of disinfectants, the best-known of which, such as "Sanitas," carbolic acid, and Jeyes's Fluid, are too well established in popular favour to need commendation. We have had no opportunity, however, of examining or testing the new-comers (if such they all are) in this branch of sanitation, but we may briefly enumerate them. "Thymo-Cresol" is the name of a compound exhibited by Messrs. Ness & Co., of Darlington. The New Carbolic Sanitary Company show the Government Pink Carbolic Powder. "Pixene" is the name of a new antiseptic derived from pine tar. Hartin's Crimson Salt, and Doughty & Co.'s "Eucalyptozone" are two other compounds which seem to merit attention.

Before concluding this notice we will return to East Central Gallery C to make mention of those exhibits in this gallery which we were unable to refer to last week.

Mr. Thomas Maccall, M.D., of Brixton, exhibits (973) the "Matlock" domestic portable Turkish bath, which claims to be a complete Turkish bath on a small scale, with efficient ventilation.

At Stand 974, Messrs. B. Finch & Co., of High Holborn, exhibit one or two specialities in the way of lavatories with trigger-motion and plug outlets, suitable for schools and public institutions. We may also mention the "School Board" tip-up lavatory, with extra-strong basins and pivot supply, and the new jet-valve lavatory, for use in industrial schools, with the view of preventing the spread of that scourge of such establishments, ophthalmia. In the case of lavatories on the jet principle hitherto provided for such institutions at the request of the Education Department, it has been customary to carry a length of iron pipe along and about 1 ft. 6 in. or 2 ft. above a continuous trough, to each side of which the children have access. The pipe is perforated on each side with a number of holes, through which the water runs in the form of jets into the trough below. The children wash their hands and faces by means of these jets, which are all running at once, no matter how few children are washing at one time. This arrangement, of course, entails serious waste of water, which is prevented by the use of the new jet valvss used at intervals (one for each scholar) on the underside of the continuous pipe. The valve is merely a simple adaptation of the ordinary spindle-valve, and is instantaneously opened and closed. This lavatory should not be missed by visitors interested in the management of industrial and similar schools. Another speciality at this stand is a seat-action wash-out closet, with good flush and after-flush. This closet appears to be well adapted for use in lunatic asylums and railway stations, and in all situations where simplicity and reliability of automatic action are essential.

Stand 975 is that of the well-known firm of Benham & Sons, of Wigmore-street, who exhibit some very excellent baths and lavatory fittings, a portable hospital bath, and an improved slop-sink.

The remainder of the exhibits in East Central Gallery C consist of soaps, sponges, towels, brushes, and kindred "companions of the bath."

Possibly there are in other parts of the Exhibition some exhibits in the form of baths and fittings which should be found in this Gallery if the distribution of the exhibits were in accordance with their classification; if so, they will be noticed on a future occasion.

WOOD-WORKING MACHINERY EXHIBITS AND APPLIANCES.

IN the Western Gallery and its annexes, where the "Machinery in Motion" is principally located, in connexion with the various groups of exhibits, we were led to expect that there would be a fair representation of wood-working machines, both steam-power and hand, but we were surprised to find scarcely any display at all, or less than could be counted on the fingers of one hand. On inquiry, there were some reasons forthcoming why wood-working machinery is so badly represented in the Health Exhibition, but these reasons were not convincing. It would seem that some of the chief manufacturers applied for space, but failed in obtaining it, or the amount they required, hence the paucity of the display. Both in connexion with the building and fitting of the dwelling and the workshop, not to speak of other structures, the operations and outcome of wood-working, steam and hand-power machines form no unimportant part, and certainly woodwork, which includes timber, the raw material as applied to articles of carpentry, joinery, and furniture, has a good deal to do with sound and healthy construction. Timber or wood, seasoned or unseasoned, is subject to various processes in the present day to protect it from dry-rot, the influence of water and damp soil, and the ravages of wood-boring beetles. Again, the utilising of machinery in performing heavy operations in preparing carpentry, joinery, and cabinet work, in sawing, mortising, tenoning, moulding, &c., has lightened the labour of our skilled artisans.

Of wood-working machines proper, there are two in the Western Arcade, Stands 1,200 and 1,201 respectively. That of the former, Mr. E. S. Hindley, Queen Victoria-street, E.C., has on view a circular saw-bench, with rising and falling spindle for the grooving of flooring boards, &c. This machine can be otherwise utilised by being fitted with band-saw and block for striking mouldings, both ordinary and those in relation to the handrails of stairs. A tenoning apparatus can also be affixed for the usual run of doors and house work. This composite machine, as we may call it, performs its work cleanly and with fair efficiency. The second stand, that of Messrs. Anderson & Hunting, Newcastle-on-Tyne, contains a dove-tailing and moulding machine for performing both kinds of work in variety. The specimens of dove-tailing and circular mouldings done by this machine, on the score of finish, are excellent. As regards dove-tailing, we gave some time since, in these pages, a review of some of the principal machines introduced for cutting various kinds of dovetails, ordinary and secret, or on the mitre. The Tighe Hamilton dove-tailer, called after the gentleman who spent several years in inventing and perfecting it, was a most ingenious machine, applicable for steam and hand power. It was capable of executing dovetails, large and small, and in great variety. A small circular saw when set in motion had communicated to it a swaying action. The pins were cleanly and accurately cut, and the tails or opens were formed, not by the cutting out of bits of the wood, but by the rotary and swaying motion of the saw, which reduced the wood of the tail spaces to dust, and thus no cutting out by the chisel was required. Messrs. Anderson & Hunting claim that their dovetailing machine possesses advantages over others for this class of work, the dovetail being, in this instance, formed by a single cutter, the tables for carrying the work being entirely automatic. The dovetail produced is known as the "lap," the pin and tail, or space, being exactly the same size. The cutter is fixed in a vertical spindle; it can also be arranged in a spindle to be applied eccentrically, to give the necessary clearance for producing the exact space needed to suit the pins. The conversion

of the machine in a few moments into a single irregular or circular moulding machine for moulding, tongueing, grooving, rebating, bevelling, stop-chamfering, and other operations, shows its great adaptability to various classes of joinery work. Although we can speak favourably of this composite machine and its usefulness, we must also say, at the same time, that all composite wood-working machines have their drawbacks; but, as some persons will have machines capable of performing a variety of operations, they must be prepared for the defects that wear and tear develope in their use. We might have added, in respect of Mr. Hindley's machines first mentioned, that in his circular saw-bench, with boring-table, the fence has a very good screw adjustment, and can be inclined at any angle for bevel cutting, or can be immediately thrown over, leaving the table clear for cross-cutting. The carrier-plate runs in a groove, and can be used for mitreing, &c., as well as cross-cutting. There is a vertical adjustment in the boring-table, so that holes can be bored at any angle. There is no display of carpenter's, joiner's, or other wood-worker's hand, bench, or workshop tools in the Western Gallery or its adjuncts, as far as we could see, the only appliances and tools of these kinds we know of being those described last week in connexion with the exhibits in the basement story of the new building of the City and Guilds of London Institute. It will not be out of place to say here that for several years American building and other workshops have been in advance of us in respect to improved carpenter's, joiner's, and other wood-worker's hand or bench tools, and thus, though the skilled workman in the United States may not work as hard as the British workman, he is enabled to get through a larger amount of general work, owing to the improvements developed in hand-tool manufacture. We are, however, making a move in this country of late, and the great advance made within the last few years in wood-working machinery for performing a variety of operations has, perhaps, tended to restrict progress in hand-tool making of the older workshop kinds.

Passing from the subject of woodworking machines and workmen's bench-tools, we come to the production of some woodwork exhibits in the Health Exhibition produced by their application. Those in respect to doors and windows, and their fastenings are not confined to any particular group or class in the Exhibition, but are scattered over the building here and there, some of them being found in connexion with the dwelling and the workshop, and some more apart. We have noticed one or two of them incidentally already; but the results may be summed up of these inventions and improvements without particularising names and stands. The necessity of providing appliances for insuring safety to life and limb in the opening, cleaning, and removal of sashes, and also in respect to the hanging of sashes, and for affixing of forms of fastenings whereby the dwelling may be secured from without, or from injury resulting from negligent action within, has led to the invention and introduction of a large number of expedients from the beginning of the century to the present. The misfortune is, that in door and sash making not only in those dwellings of the ordinary kind, but even in what are called superior middle-class houses, the joinery work provided, particularly since the first quarter of the present century, has gradually become poorer and thinner in scantling, and the framing, as a consequence, less strong and enduring. A good sash-fastener or other appliance in connexion with a flimsy window-frame and pair of sashes is just as much out of place as good locks and hinges with doors of the same miserable materials and workmanship in regard to house doors. On the score of skilled labour and good materials, some of the sash appliances in the present Health Exhibition are creditable enough, but instead of being simple in their adjustment they are rather complex, and entail from two to three and more operations. A system of pushing back and forward of knobs, with other interlocking arrangements entailing the use of keys, is a system which can never be adopted in ordinary houses. Except in houses of the better class, occupied by families who can afford to keep a number of servants, and where a certain discipline in house work is exacted, domestics cannot be got to do, or continue to do, the necessary operations which most of our lately-introduced appliances entail. In ordinary dwellings the majority of these improved sash appliances would be broken or out of gear in a few days from rough treatment, even if otherwise their expense did not preclude their use in any but first-class dwellings. In the Carpenters' Hall exhibition we pointed out the obvious defects of an expedient in relation to taking sashes out of their frames with their cords attached without removing the parting-beads and inside stops. The ingenuity of the inventor in that case only produced weakness in the construction of the sash-frame, which would be more and more developed by wear and tear, leading eventually to an unsatisfactory state of matters. In the Health Exhibition we have what is termed "an improved window-frame and sashes," constructed to enable servants and others to clean the inside and the outside of the glass of both top and bottom lights, from the inside of the room when standing on the floor. Although there are no pivots here, there is a spring catch to be turned at the bottom, and next there is an application of a key to unlock the sash to enable it to slide. The sashes are hinged to pieces on each side, which may be termed in a manner false stiles, which slide along with the sashes in raising or lowering, and which allow the sashes at the same time to open inwards to be cleaned. This system, though ingenious, will not answer for general practice, for reasons already stated. French casement-sashes can be made to open inwards or outwards, but there is always a difficulty in making them weather or water tight without very exceptional provisions. Again, casement-sashes are not fitted for the British climate, although they will be found in many first-class houses in this country. We examined another window-frame with sashes fitted with "improved" appliances, by the use of which it is claimed that it is possible to dispense with outside work in cleaning the lights, both sashes being so fitted that by certain arrangements they can be turned inward. Here, too, simplicity is absent, though good workmanship and materials may be present. There are other window appliances, but to describe them would be to little useful purpose; for, although under special circumstances and care in well-regulated households, they might be found to answer; they never could be adapted to general use in dwellings. Of sash-fasteners alone, used merely for the purpose of tightly holding the meeting-rails of both lights together, and thus securing both when shut from shaking or from being opened from the outside, there have been some scores of patterns introduced, and the majority with indifferent success. None of the exhibits in any of the galleries of the Health Exhibition satisfactorily solve the difficulty, for the best of them err greatly on the score of complex arrangement in device as well as cost. The old barrel sash-fastener of our grandfathers' time, with its screw and spring, was one of the best of the old kind, and under certain modifications it is being again introduced. The defect of the old barrel sash-fastener was incidental to its wear and tear, and was also partly owing to the accumulation of coats of paint on the top-rail of upper sash and sill of lower sash, which prevented the meeting-rails of both sashes on their top surface from coming level together. After all is said that can be well said in regard to the hinging of sashes, the ordinary pulley system with good sash cords and weights behind the pulley stiles remains the most useful and applicable still, with all its obvious drawbacks.

In the East Central Gallery, in which some of the above window and sash appliances are exhibited, there is a door and frame complete, fitted with Stevens & Major's patent hydraulic door spring and check. This new and improved appliance is shown by Messrs. Smith & Stevens, Queen's-road, Battersea (Stand 903). There is no rebound in this case when the door is pushed open and allowed to swing back into position. The spring is so adjusted that it allows the door, when opened and then released, to move steadily back and remain still, without any rebound common to door-springs similarly placed. The Norton door check and spring, exhibited by Mr. R. Adams, and incidentally noticed previously, is a serviceable appliance in several positions. It prevents the slamming and banging of doors. Here the device consists of cylinder, piston spring, and self-adjusting value. It is adapted to be affixed to the top part of a door and the frame over the door. There are two powers or forces embodied, the spring which closes the door and the check which, on the cushioning of the piston on air, brings the door to a stop near the jamb, then immediately and quietly closing it by the operation of the spring regulated by the automatic valve. This "Norton" door-spring is at present in use in a number of our public buildings in the City and provinces.

In the East Gallery and East Central Gallery there are some furniture exhibits, home and foreign, possessing notable features. In the house furniture, manufactured in the furniture centres of London, there is great improvement evidenced of late years in design, many of the articles being quite as artistic as the foreign exhibits, and more substantial in material and framing. We allude, of course, to the outcome of our best and old-established houses, for we are thoroughly aware that a wretched class of furniture is still turned out to meet a certain market which exists for such cheap and nasty goods. The Austrian bent wood furniture (Stand 917), shown by Jacob and Josef Kohn, has its admirers in this country, and on the score of efficient bending and finish it deserves commendation. We think there is an opening in this country for a similar industry, with indigenous woods, several of which possess great strength and elasticity. The application of hot water or steam is necessary, with other requisites, though we have two or three native woods which are capable of being bent into almost any shape without steaming or the application of heat. We have also a number of woods in the British islands capable of being utilised for parquetry floors, possessing strength and variety of colour. Work with these woods could be turned out quite as good as the specimens in the Health Exhibition into which mahogany and other foreign woods enter. True we have no native mahogany, but we have dark and light oak of extreme hardness, walnut, hornbeam, sycamore, maple, holly, pear-tree, beech, laburnum, thorn, hazel, cherry, wych-elm, yew, bog oak (in Ireland), and other variously coloured woods, some taking a beautiful polish.

In conclusion, we may add that we are not at all disposed to raise the question of "Machinery *v.* Hand Labour" in any antagonistic spirit. Capital and labour should work in harmony, for all capital is the produce of labour; yea, labour is capital, and a day is perhaps coming when skilled workmen will find that through co-operation their most honest and best desires may be obtained to the injury of no really legitimate interest. We desire at the same time to see hand labour dignified and sustained by a class of practically-educated operatives. We are not admirers of manufactured or machine art, and if the outcome of the Health Exhibition and our technical schools tends to the production of higher excellence in handicraft, or the work of the hand, lasting benefit will be secured to the industrial arts of this country.

HEALTH EXHIBITION LECTURES.

CANDLES.

ON the 20th inst. a lecture was delivered by Mr. Leopold Field, in the lecture-room of the International Health Exhibition, on "Candles."

Sir Frederick Abel presided, and in introducing the lecturer observed that one of the lessons that had been learned from the International Health Exhibition was not to assume too hastily that any subject was not intimately connected with the public health. More especially with regard to candles he could speak as to the injury which had been sustained by students working by night by the light of candles of indifferent manufacture. It was a very great improvement, both as regarded health and safety, when candles were introduced which did not require snuffing.

The lecturer, after some general remarks, observed that doubtless some persons on finding "candles" unblushingly presented as promoters of hygiene would be disposed to ask what on earth candles had to do with public health. The candle had, however, kept pace step by step with the progress of civilisation, and every new departure in manufacture had been attended with a distinct improvement in the candle, and a better application of its great uses for the benefit of mankind. In primeval conditions there was not the same need for candles as now. Our forefathers retired to rest as the evening came on, and this was the case, to a more limited extent, now in agricultural districts; but here, where we were accustomed to the day being turned into night by the sudden clouding of the atmosphere, it was necessary that the

appliances which once administered to a very different state of society should be of the most perfect kind. The earliest news that came to us on the subject of candles was with regard to the old slips which were taken from the pine and dipped in resin. Then came the link, which gave a brilliant light, and the smoke was not, comparatively, so very great. But the link was not handsome, and gradually tallow and wax candles came into use. Wax was, of course, used by those who could afford it, the poor confining themselves to tallow. The rush-light they were familiar with, and it was still used by some people for the sick chamber. Associated with the ordinary tallow candle were the snuffers. It was not till the nineteenth century was far advanced that science might be said to have taken the candle in hand. The sperm fishery commenced, and spermaceti was yielded by the sperm whale, and from it was made the purest and most desirable candle, but it cost double as much as the ordinary candle. Chevreul, about 1811, brought his intelligence and knowledge to bear on the subject, and effected some important discoveries. He would explain what was absolutely essential in a candle. There were two things to be considered in constructing it. In the first place they had to make a wick with the exact amount of melting matter all the way through, and in the second place they had to contrive that the flame should be big enough to burn that melted matter and not be drowned by it. These were points which the candle-manufacturers set themselves to discover, and he thought they had succeeded as well as it was possible with the varying materials before them. There was nothing so difficult to bring to perfection as the candle. From every part of the earth or ocean where there was animal or fish they derived some constituent of the candle. And when they had got the required coating there remained the wick, and here was the great difficulty, for the wick was by no means so simple a thing as it no doubt appeared to many people. The lecturer then went on to mention that many descriptions of wax were used in making candles, but the wax of the bee recommended itself to everybody. The process carried out now was the same as when wax candles began to be made in any large quantity. No great advances had been made in that respect. It still remained a fact that wax candles could only be made out of wax which had been bleached by exposure to sun and air. Various kinds of wax came from all parts of the world, of different colour, appearance, and smell, and all were made use of in making the candle. Great care was necessary in selecting wax for bleaching. After it was bleached it was placed in store-houses; and it went through various stages during the three days that elapsed before it was in a condition for working. Mr. Field exhibited a splendid wax candle, 28lb. in weight, and the value of which was 15 guineas. The same process was, he said, gone through in making it as in producing candles 400lb. to 11b. and four for a farthing in price. Owing to the nature of the substance it was impossible to make them by machinery; they had to be dipped and trimmed again and again until the required size was obtained. After giving a practical illustration by experiment as to the way in which a nice wax candle could be produced, he went on to refer to mould candles, which came into use about the middle of the seventeenth century, and might be taken as an advance in enlightenment. He observed that it was remarkable how long it took for the machine-made candle to get into popular favour, seeing how great were the advantages of the invention. The link and the spermaceti candles connected them with the past, but Chevreul made important discoveries which he had successfully brought to bear in the manufacture of candles. The lecturer having shown the nature of these improvements by experiments, passed on to the discovery of paraffin, which was produced from shale, and remarked upon the great reputation which had been made by Mr. Young in the manufacture of paraffin candles. Scotland was the great field for these candles, as it was there that shale was found in great quantities, and they held their own against the enormous influx of American goods. In conclusion, Mr. Field drew attention to numerous specimens of candles which were displayed on the tables on the platform, of all colours and sizes, which had been made from the products of shale. He showed how paraffin candles were manufactured, producing some beautiful specimens, and remarked that Young had passed away but Chevreul still lived, and, he hoped, would see the eve of his hundredth anniversary illuminated by the improved lights he had called forth as compared with that of the once nasty and disagreeable tallow.

THE HISTORY OF ENGLISH DRESS.

ON Tuesday afternoon the Hon. Lewis Wingfield delivered a lecture in the Conference Room on "The History of English Dress." Mr. George Augustus Sala presided, and in a few opening remarks said it was almost superfluous that he should introduce the lecturer, Mr. Lewis Wingfield, who was well known as an authority on costume, and moreover, he had arranged for public inspection, in the West Quadrant, one of the most popular features of the Exhibition, to which had been applied the epithet of "Wingfield's Waxworks."

Mr. Wingfield commenced his discourse by remarking that the dress of mankind had always consisted of a dress, short or long, tight or loose, according to the particular period when it was in use. For instance, the early Romans, who lived in a warm climate, adopted a loose mode of attire, which was the more comfortable, while the denizens of the North, accustomed to war and the pursuits of the chase, chose garments which fitted close to the skin. In the olden days colours were few and far between, and many of the garments worn were very similar to those in use at the present day. The diagrams which he exhibited on the wall conveyed a better idea than could be gained by any verbal description of costumes in vogue at different periods of history. Mr. Wingfield here exhibited a picture of Boadicea, her garments having been designed in accordance with the description given of her appearance by Strabo. The portrait was that of a handsome, tall, full-grown woman of somewhat stern countenance, with long hair flowing over her shoulders. She wore a couple of plates of steel. The next portrait was that of Hengist, who was by no means a prepossessing individual. He regretted to have to say that the heroic Hengist was carroty, that he was freckled, and that he was fat. The Anglo-Saxons clung to short skirts while their Norman lords went about in long robes. The Norman ladies put the Saxons to shame in the matter of attire: they wore their hair in long plaits behind, and with much gold and many gems mixed up with it. He now came to a subject which he must approach with 'bated breath—he meant the under garment called "stays." The first use of the corset spoken of was by the Countess of Leicester in 1265. Terence referred to ladies who saddled their backs and laced their waists to make them elegant. They had evidence, however, that gentlemen wore stays as well as ladies. Chaucer spoke of slender waists being genteel. Queen Eleanor devised a corset of steel, a model of which the lecturer exhibited, it bearing much more the appearance of a piece of armour than an article of dress. Whalebone stays came into use in the time of Elizabeth. James I. insisted on all his courtiers cultivating a wasp-like waist, but possibly the most harrowing corset ever brought into use was that of the time of George II., the front being made of wood. It was not easy to understand why, after the discovery of whalebone, they should have used timber. The warriors of Gustavus Adolphus wore stays. The "Fiend of Fashion,"—a reproduction of an old caricature,—showed the corset of the period in all its beauty. The eccentricity of costume reached its climax in the time of Richard II., and many attempts were made by way of legislation to put a stop to extravagance in this matter. The writers of the day, too, were never tired of inveighing against the foppery of fashion; but for several reigns there was little improvement recognisable. It was curious to note, with regard to this period, that the long robe came into general use, and it was almost impossible to distinguish a lady from a gentleman. The beginning of the sixteenth century brought with it a complete alteration of fashion; men gave up flowing robes, and boots were worn the shape of which had some regard to comfort. Although the square-toed boots were not handsome, they were better than the peaked toes 2 ft. long formerly in use. Women about this time adopted a head-dress similar in all material respects to the modern bonnet. This was the period of the Renaissance, a time of luxury, and costume was very expensive. Henry VIII. made very strict sumptuary laws, although he and his Chancellor, Wolsey, delighted in all kinds of finery and display, and in this legislation he showed his characteristic selfishness. James I. invented a new hat, which developed later into a Cavalier hat, and afterwards became diminished into the modern wide-awake. The flat brim and tapering crown of this hat constituted quite a new departure, and the origin of this was traced to Spain, whence it was introduced into France by the League, and known as the "Chapeau Henri Quatre." The lecturer at some length referred to the use of wigs, powder, patches, &c., illustrating his remarks by quotations from Gay, Cibber, and other writers of the period. The hoop dated from the time of Queen Elizabeth, and was always very inconvenient. It was then known as the farthingale. The fashion was caricatured by Hogarth. Absurdity reached its acme when "maccaronis" came into existence. The use of "false hair" obtained a fair share of the lecturer's attention. He gave a humorous account of a reception given by Prince Frederick and his newly-made bride sitting up in bed, and also of the opening of a lady's head in the days of exaggerated perukes.

The Chairman, in moving a vote of thanks to the lecturer, observed that he was sure he was only expressing the feeling of the entire audience when he said they had listened to Mr. Wingfield's address with equal interest and amusement. He had not only delighted but he had instructed them. He felt satisfaction in the reflection that there was an absence of tyranny in the selection of modern costumes, and he protested that men were every bit as good milliners as women, but they had never yet been able to manufacture a bonnet. In that matter they had shown their utter incompetency and incapability. He concluded by stating emphatically that he preferred modern to ancient costume because it fairly obeyed hygienic principles, to the lessening of such diseases as consumption, which was much more prevalent forty or fifty years ago than now.

Mr. Edward Levy Lawson briefly seconded the resolution, which was very cordially received.

Capt. F. S. Dumaresq de Carteret Bisson proposed a vote of thanks to the chairman, which was seconded by Mr. J. L. Toole, who remarked upon the enthusiasm of the female portion of the audience who had brightened up the lecture with their interpolated applause, and had approached to the very feet of the lecturer with ear-trumpets to catch every word that fell from his inspired lips.

HEALTHY BUILDING AND LEGISLATION.

IN connexion with the Exhibition the Social Science Association has been holding two afternoon conferences on subjects relating to health. The following is a portion of a paper read on Thursday by Mr. H. H. Collins, under the title, "What Conditions are essential for a Healthy Dwelling, whether in an Urban or in a Rural Locality; and how far is it desirable that they should be rendered compulsory by Legislation?"

The question divides itself into two heads, the first of which alone opens out and embraces the whole field of hygienic science; yet, great as it is, it might be answered in one small word,—cleanliness; for this is the essential of all sanitary work, and is its synonym. What does this mean? The conservation of God's common gifts to man in the same condition as they were rendered to him,—unsullied air, pure light, unpolluted water, uncontaminated soil, and sanitary surroundings. These conditions can, however, only be obtained by strict attention and adherence to nature's teachings. They are each and all interwoven and interdependent. Neglect of one inevitably produces injury to the other.

The evil attendant upon unclean "ground-air" has been proved to demonstration by Pettenkofer. This air, he proves to us, in its ceaseless motion, is ever absorbing itself into the underground water, penetrating into the substances forming the soil, sinking or rising by difference of temperature, or influenced by barometric pressure; sometimes causing putrefaction, and at other times acting antiseptically, always ready to intrude and commingle with the air of the house, bringing with it those microscopic and morbific germs, ever ready to germinate in suitable soil.

Now, it is well known that the quality of air

is ordinarily tested by the amount of carbonic acid gas which it contains. Pettenkofer's investigations go to show that "ground-air" invariably contains 50 per cent. of this gas more than "ground water," so he adds, it is clear that it is the air which impregnates the water, and not, as is generally supposed, the reverse; and he draws the natural inference, that the source of this gas is to be found in the soil; that it parts with it simultaneously to both air and water, but with far greater facility to the air than to the water. I have dwelt rather long on this subject, because a healthy foundation is the fundamental essential of a healthy dwelling.

What are the lessons to be derived from these facts? That, irrespective of all statistical or constructive considerations, we must, before all things, drain the subsoil of our houses and their surroundings, and confine all impure emanations by sealing the sites with impervious coverings of concrete or asphalte,—that the formation of our roads, and the surroundings of our dwellings, must be similarly treated,—that no soil must be considered as "virgin," but all must be carefully examined, and every precaution taken to ensure this first essential, a healthy foundation upon which to erect a healthy house. Poison the soil, and you poison the atmosphere.

Our next care must be not to foul the air by bad drainage. All connexions between the main sewer and the house must be studiously avoided, since gases pass, sooner or later, with the greatest ease through all water-traps, and evaporate into the air of the house, and so pollute it; we must periodically examine and cleanse our drainage system, and so lay the pipes as to admit of this being done with ease and economy. Remembering that the air, like water, travels and flows, we must, by the interposition of areas, or by cementing or asphalting the walls where the earth abuts against them, shut out and prevent all air currents flowing to the interior of our houses.

The aspect and location of rooms must be sanitarily adapted each to its several uses, so that every apartment may freely partake of surrounding pure air, and each have its due proportion of sunlight (when this can be obtained); for it must not be forgotten that in this climate it has been calculated that we only obtain 189 days of sunlight, and that last year, according to the Astronomer Royal, we only enjoyed fifty-one days seventeen hours.

To insure *pure light*, important as, and coincident with, *pure air*, care must be taken that our houses are built with sufficient space surrounding them, to such a height that they will not overshadow each other, and so planned that only a certain number shall be permitted to be erected per acre. Rest assured that a dark house must engender an insanitary condition, irrespective of its depressing and lowering tendencies. A house bathed in air possesses in itself an antidote to many of the evils I have sketched. But given a well-selected and protected site, with good drainage, clear sunlight, and well-planned accommodation, one precaution must be insisted on if we would maintain the sanitary state of things we have taken so much trouble and expended so much thought to obtain. We must not "overcrowd." The cubical contents of the rooms must be proportioned to their inmates. Overcrowd the most sanitarily-arranged domicile, and ultimately it becomes totally unfit for habitation. Not only do we destroy the purity of its atmosphere, but we generate deleterious organisms, which live and thrive in the *very* interstices of the materials of which the house is composed, and once created and vivified, it is seldom that we are able to destroy them. Never should the axiom formulated by that eminent sanitarian, Dr. Farr, be forgotten, that just in proportion to density, or proximity of population, is its mortality.

Water, the next essential,—the absolute necessity of life,—the medium of all others most easily fouled,—the most fertile cause of insanitary conditions,—how shall we preserve it pure and undefiled? By strict attention to the state of the air. We have only to peruse that most charming volume "The Floating Matter in the Air," from the pen of Tyndall, to convince ourselves of the necessity of adopting the greatest precaution in this respect. I venture to assert that, beyond a doubt, a single virus of disease may impregnate a source of water and give life to myriads of bacteria and other low forms of organisms, perhaps the origin, certainly the producer, of disease. Do we want confirmation, we have only to make ourselves acquainted with the admirable researches, and their beneficent results, of Lister, Koch, and Pasteur, as evidenced by the stamping out of the anthrax of the cattle, the pébrine of the silkworm, the chicken cholera of the fowl.

Yet let us bear in mind that Tyndall proves to us that these beginnings of life "are only noxious when out of their proper place." Our plumbing, therefore, should be most carefully contrived, with pipes of good and perfect manufacture, tested to a strength sufficient to withstand any outside influences; joints carefully made; wastes and overflows disconnected from drains; improper types of water-closet apparatuses discarded, with traps cautiously applied, and, when used, of proper construction; with soil-pipes open at top and bottom, and freely ventilated, positioned away from all ingress to the house, with rain-water-pipes similarly treated. Baths, lavatories, and sinks, not only of best character, but likewise sanitarily located. With cisterns so positioned as to be facile of access, and of such material as to admit of easy cleaning; with drinking-water so jealously guarded that by no possibility can it have any connexion with that used for ordinary cleansing or ablution purposes. With filtration so contrived that the filtering medium can be periodically and readily renewed; with ample supply (supply enough to waste if you will) profusely used for flushing and cleansing purposes, and when once soiled instantaneously removed from the house and its precincts.

Lastly, it should be a canon of water supply that nought but pure and undefiled water should ever be allowed to remain within the healthy house, and this points to the necessity of a constant supply. All the sanitary provisions which I have thus hastily generalised will be rendered comparatively nugatory if the surroundings of the house be contaminated; for doors, windows, ventilation, and even walls, whether of brick or stone, will admit immundicity. One of the greatest offenders is the dust-bin; it is, and has been, more productive of disease than it is credited with. No vegetable or organic matter should ever soil its interior, such should be invariably burned: it should be manufactured of light galvanised iron, constructed with a lid so as to prevent the insertion of improper materials and to obviate the scattering of its contents. A new dust-bin per annum would not be an extravagance.

In the grounds of the Exhibition will presently be exhibited, side by side, sections of a sanitary and of an insanitary house. The subcommittee who have planned the same (of which I have had the honour and pleasure of being a member) have sought therein to show some and some only of the conditions which constitute a healthy and unhealthy house. They have laboured, however, under the same difficulty which I have experienced in preparing this paper, viz., the dealing with a very large subject with inadequate time, means, and space at their disposal; and when you shall criticise the confessedly imperfect details of their labour, I ask you to judge of them with kindly consideration, bearing in mind that a mere educational sketch is presented, although it is an honest endeavour to bring home to the minds of the uninstructed multitude the evils which exist and the ease and economy with which they can be avoided and rectified.

There is one subject which, however, I should wish to bring before this Conference, viz., the enormous height to which houses are now being erected, caused by the extreme value of land, or other economical exigencies,—but, nevertheless, effecting insanitary conditions of a grave character, shutting out light and air, and sinking the occupants of the lower stories into wells of stagnant atmosphere. Let me direct your attention to a model of an Artisans' Building (shown in this Exhibition) of this description, about to be erected in the Minories by the Metropolitan Railway Company, about ten stories high, with enclosed areas or inner courts, and surrounded by other properties. Should such a work as this be permitted? We have the testimony of Dr. Beddoe "that lofty staircases tell unfavourably on the health of those frequently ascending them, producing anæmia and functional affections of the heart,"—and who can doubt it? Surely, buildings of this class are not the outcome of philanthropy, but of crass sanitary ignorance.

Sensible that I have omitted much which should have been stated in this paper, had time permitted, I beg to submit that all the essentials which I have enumerated are as necessary for the sanitary well-being of a rural as of an urban dwelling, and that all the precautionary measures suggested are as capable of being applied to the one as to the other,—of course under different conditions,—for example, probably irrigation would take the place of drainage proper, earth or pail closets of water closets, and so forth.

In the Sanitary and Public Health Acts of the United Kingdom will be found ample provisions for ensuring the hygienic precautions necessary to the perfection of healthy habitations. The difficulty is to obtain an energetic administration of the law as it exists.

Amongst those amendments which I venture to think essentially necessary are, *uniformity* both in action and area; abolition of distinctions between *urban* and *rural* districts; the application of the Sanitary Acts to the whole kingdom; the recession of exemptions; and independent and clearly-defined status for our medical officers of health with adequate remuneration; properly educated and certified inspectors; and above all, a moving, controlling, and initiative power embodied in a minister of health, endowed with responsible authority, and assisted by the best scientific, medical, architectural, and engineering ability; such an authority as this would lend dignity to the office, and would stimulate the local authorities throughout the length and breadth of the land. This has been advocated and urged by our Association for many years; it would be more efficacious than drastic remedies and sanitary policedom.

There are three moods through which local authorities generally pass, but they are not in grammatical succession; the first, unfortunately, is the *potential*, the second the *infinitive*, but the third is the one which I am in favour of, the *imperative*, and this, therefore, is the answer which I render to the last portion of the question,—Legislation to be effective should be *compulsory*.

With this we bring to a close our series of special Health Exhibition Supplements, but we shall have more to say about the Exhibition from time to time during the next few weeks.

HEALTH EXHIBITION.

MR. RICHARD ANDERSON, F.C.S. author of "Lightning Conductors: their History, Nature, and Mode of Application," makes a Speciality of Testing the Efficient Action of Lightning Conductors; and of giving Advice as to the best mode of applying the Apparatus for the Protection of Public and Private Buildings.—Leadenhall House, 101, Leadenhall-street, E.C.

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